# CHAPTER 3

# RESEARCH METHODOLOGY

## 3.1 INTRODUCTION

This chapter focuses on methodology in sampling and data analysis strategy. The research design of this study will be elaborated with detailed procedure to carry out data collection process in this chapter.

## 3.2 SAMPLING SITE

This study was carried out in a controlled domestic kitchen in a one-storey house in Taman Mahkota Aman, Kuantan. A domestic kitchen is chosen to conduct the sampling of the emission, because there is no laboratory kitchen in Kuantan area and sampling in a commercial cooking kitchen is not allowed as it will disturb the kitchen operation. All the sampling protocols were conducted in this domestic kitchen where all the conditions in the kitchen were well managed and controlled to ensure no disturbance and confounding effects from other parameters (i.e. ventilation, humidity, foreign airborne particles, room arrangement, building materials, outdoor infiltration, and non-related cooking gas) (Huboyo et al. 2011).

The kitchen size was measured and the plan layout was drawn to illustrate the sampling site of this study. The size of the kitchen is 23cm (L) x 163cm (W) x 123cm (H), with a volume of 461,127cm$^3$. The layout of the sampling site is illustrated in Figure 3.1 (a) and (b).

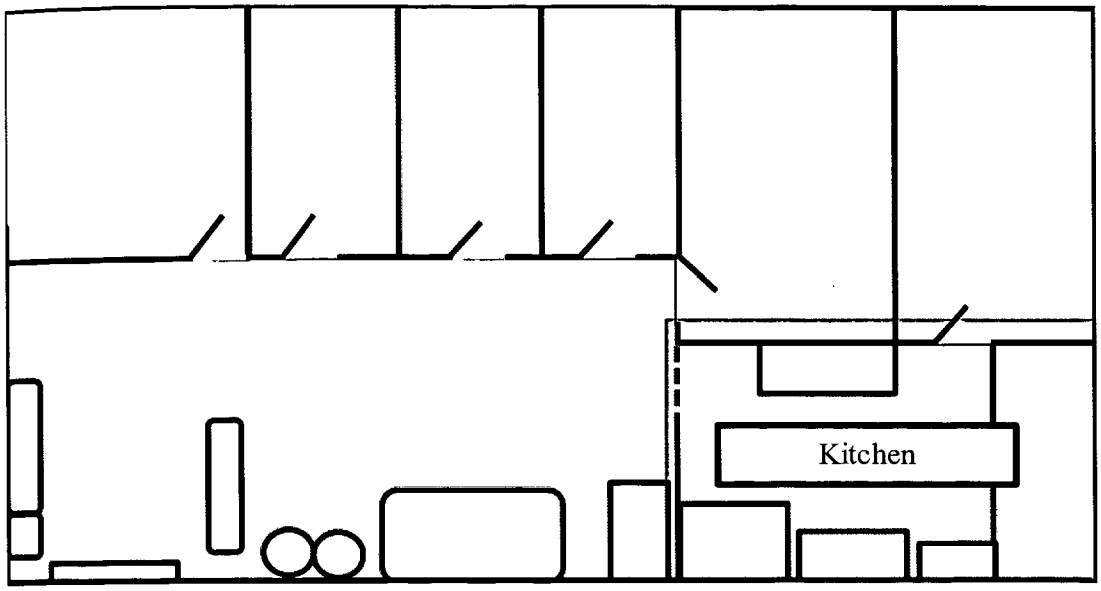


**Figure 3.1 (a):** One-storey house plan layout

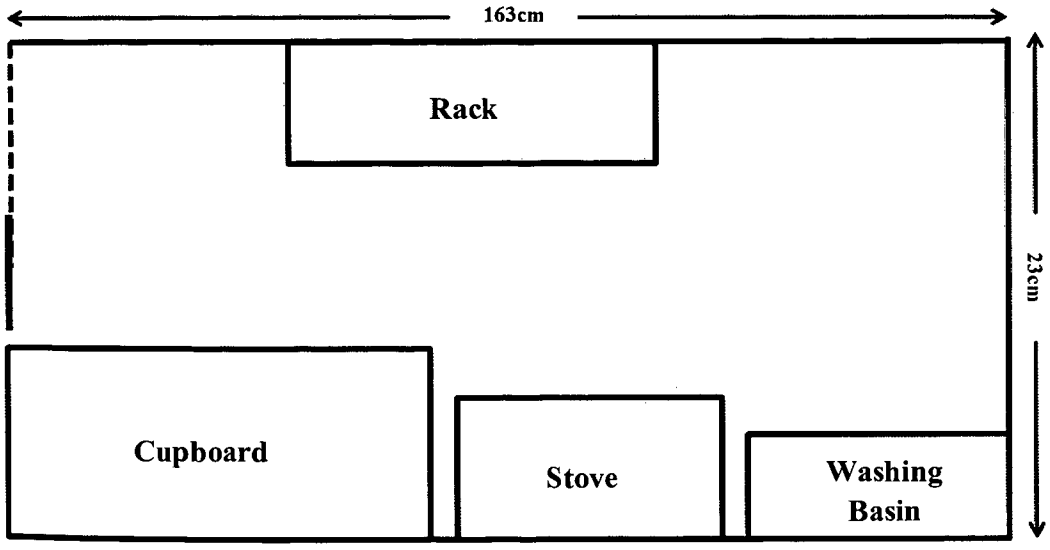


**Figure 3.1 (b):** Kitchen plan layout

**Figure 3.1 (a), (b):** The overall map of the house and kitchen of sampling site

## 3.3 RESEARCH DESIGN

This study is an experimental research design where the experiment was conducted in a controlled domestic kitchen. Counterbalanced measure design was employed to test each variable (i.e. cooking stove type and cooking temperature). Counteract each variable was intended to reduce the chances of the distortion of results by the order of treatment or other factors. By employing this design, the effect of the cooking conditions (i.e. cooking stove type and cooking temperature) and the $PM_{2.5}$ emission during cooking activities were investigated via quantitative analysis. The cooking events were repeated while the parameters interested were altered to investigate the difference of the changes and its effect on the emission.

## 3.4 STUDY SAMPLE

The main focus of this study is on the emission of $PM_{2.5}$ resulting from various cooking conditions. The population of this experimental research is the particles emitted from cooking activity. The data taken were measured in term of total particle number concentration to be computed to get particle emission, air change rate, decay of particle number concentration and individual intake.

## 3.5 SAMPLING PROTOCOL

There are three phases of sampling in this study: (1) air change rate, (2) cooking sampling and (3) data analysis. Phase 1 and 2 was conducted in the controlled kitchen, where as Phase 3 was conducted in computer lab.

Phase 1 is the measurement of air change rate. Tracer gas concentration decay method was employed and the gas used was $CO_2$. The sampling of $CO_2$ was done with TSI IAQ7545 Indoor Air Quality Meter (Figure 3.2). The sampling episode was divided into 3 periods: (I) background testing, (II) injection of $CO_2$ and (III) post decay measurement until background level is reached. The kitchen was first made sure to be of minimal air movement. Door and windows were closed and there was no particle emission from any activities in the house. The background testing took 5minutes and